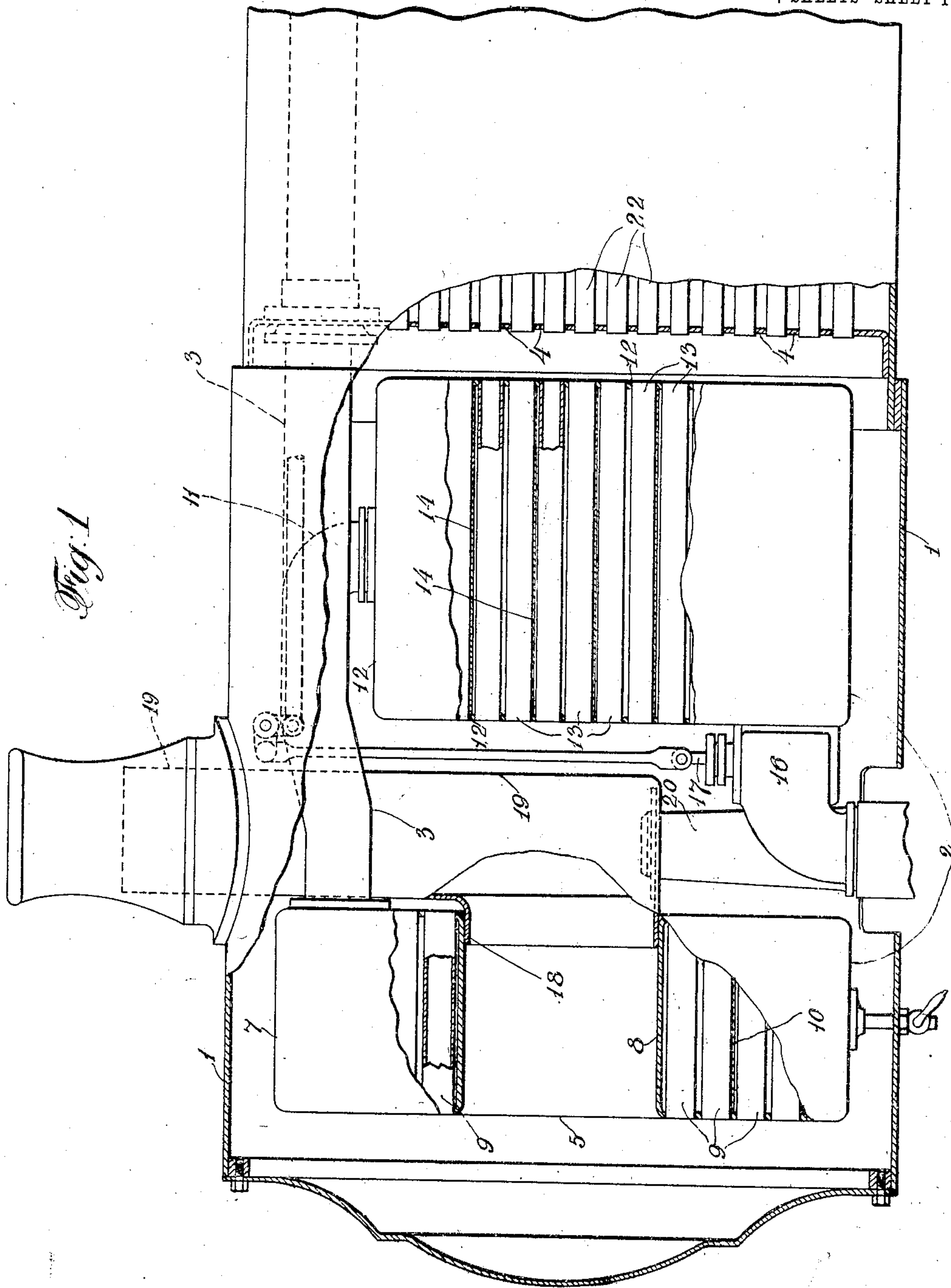


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STEAM SUPERHEATER.  
APPLICATION FILED OCT. 24, 1908.

911,993.

Patented Feb. 9, 1909.

7 SHEETS—SHEET 1.



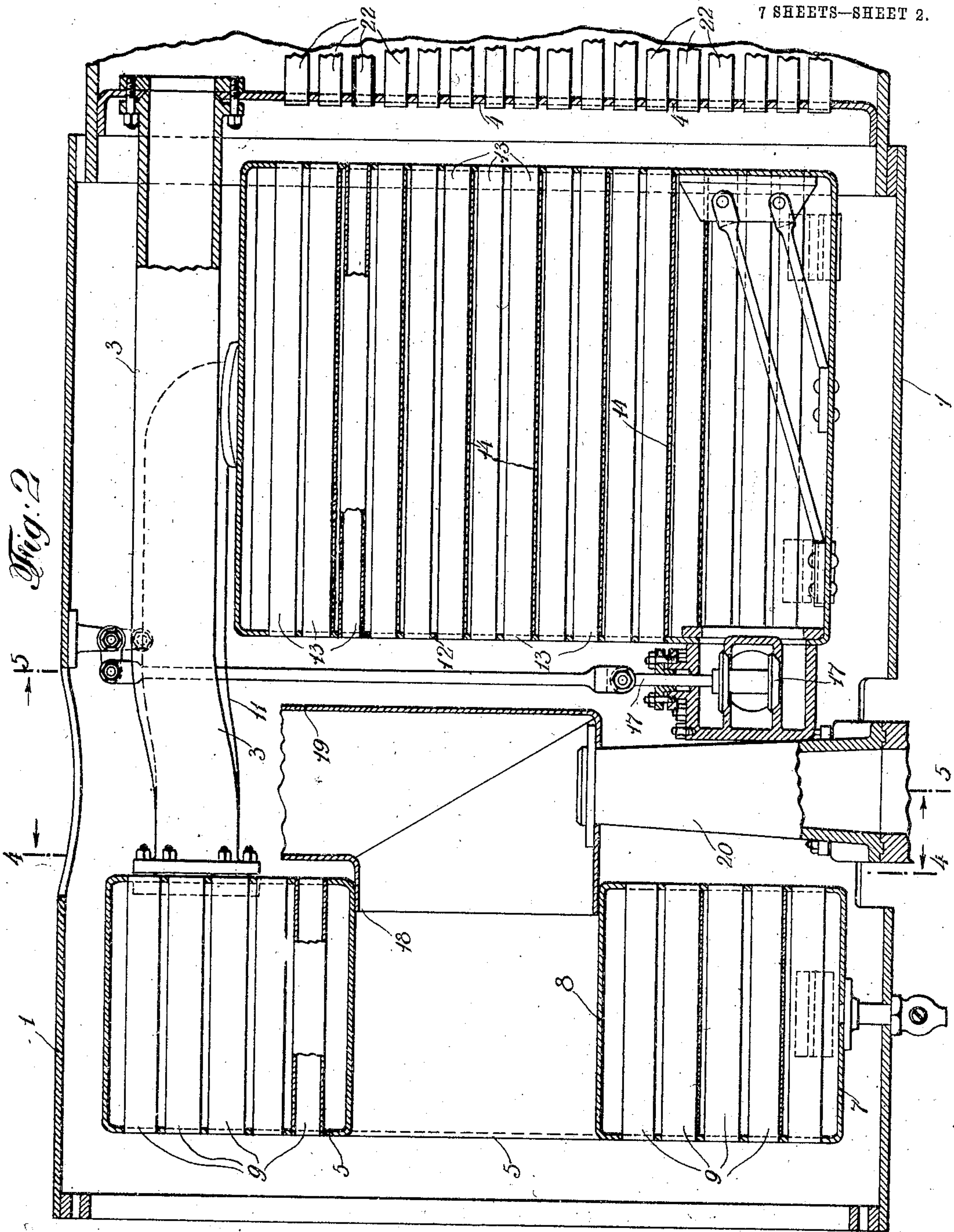
Witnesses:  
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7 SHEETS—SHEET 2.



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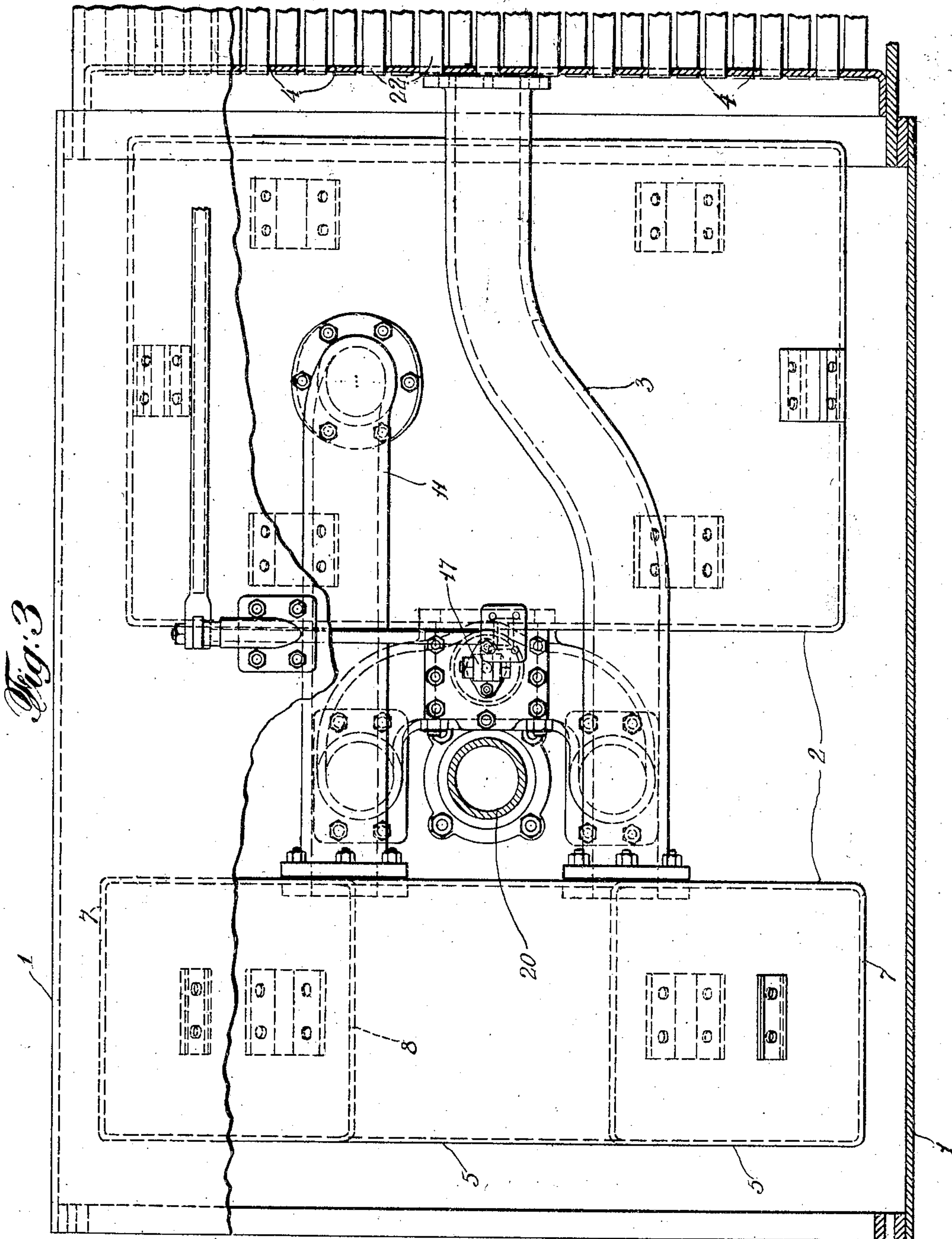


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7 SHEETS—SHEET 3.



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7 SHEETS—SHEET 4.

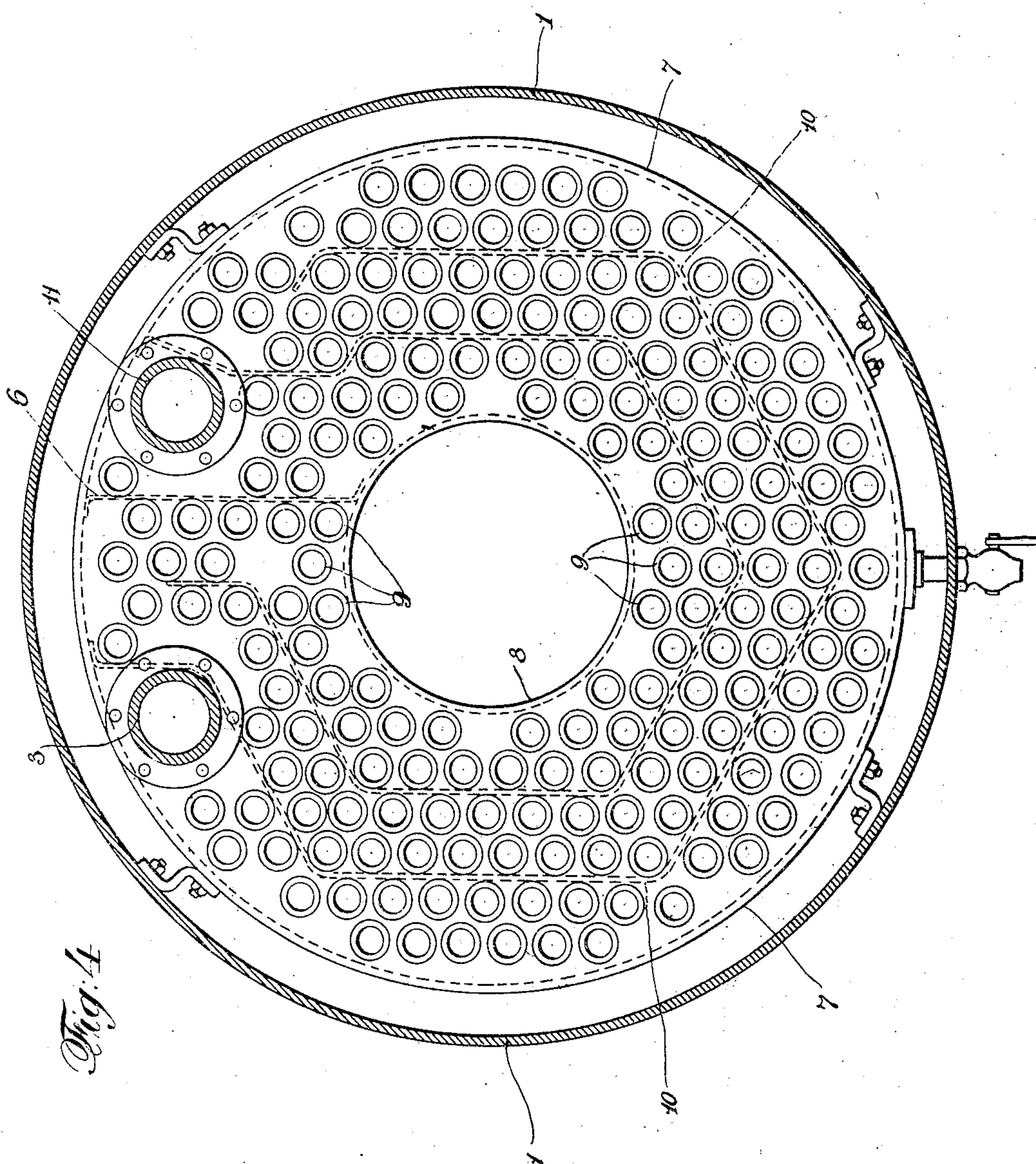


Fig. 4

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7 SHEETS—SHEET 5.

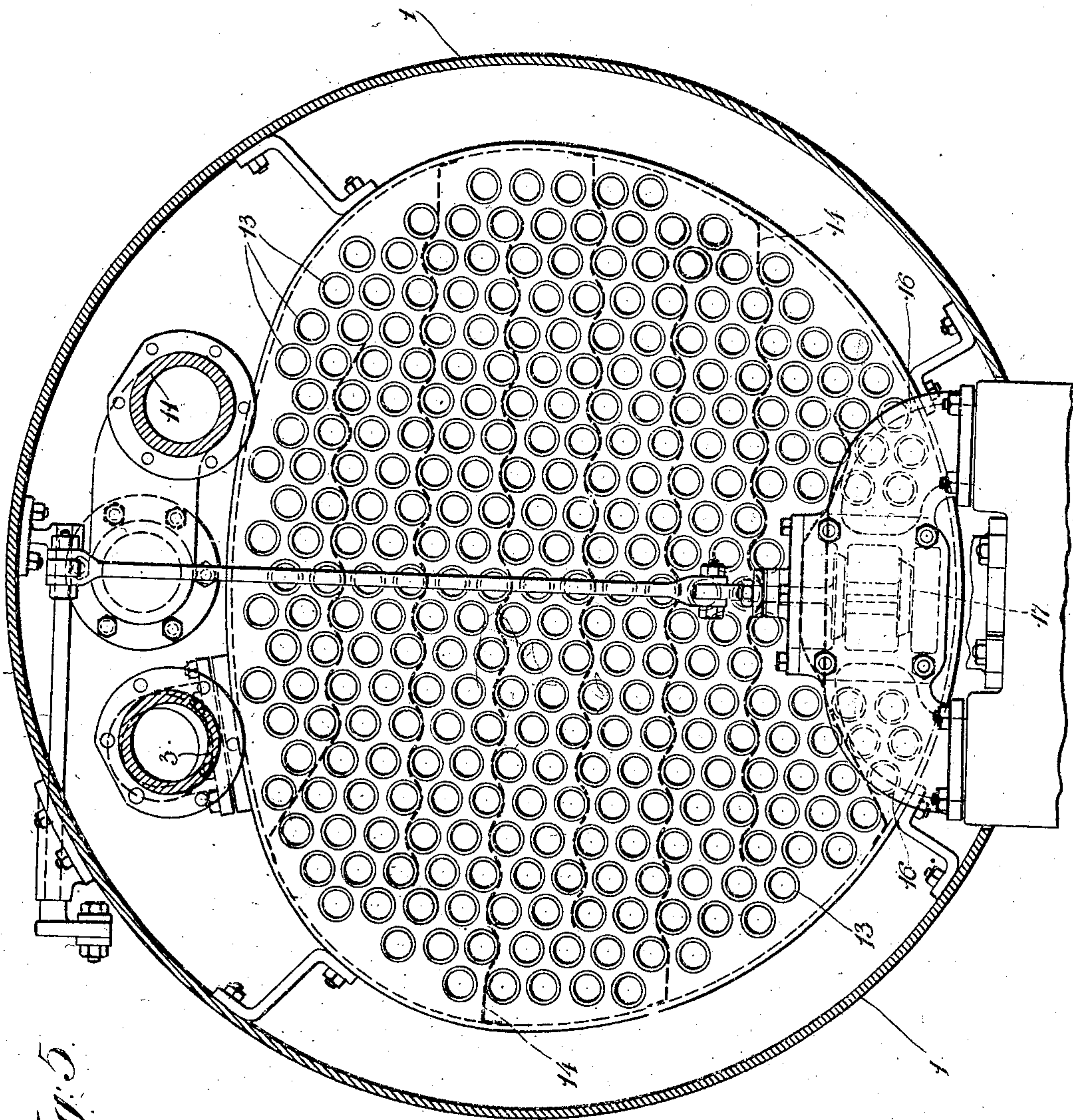


Fig. 5.

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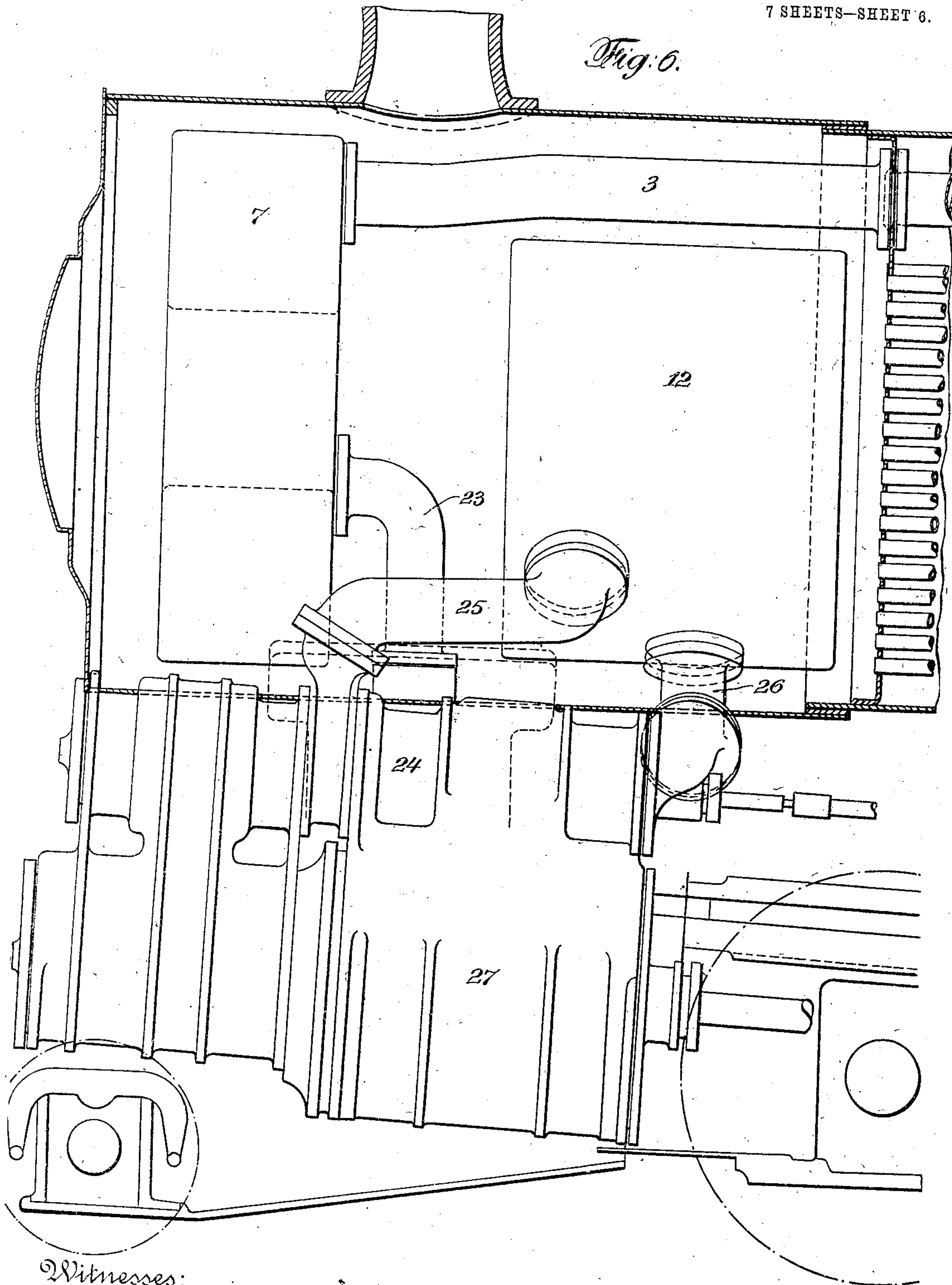
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7 SHEETS—SHEET 6.

*Fig. 6.*



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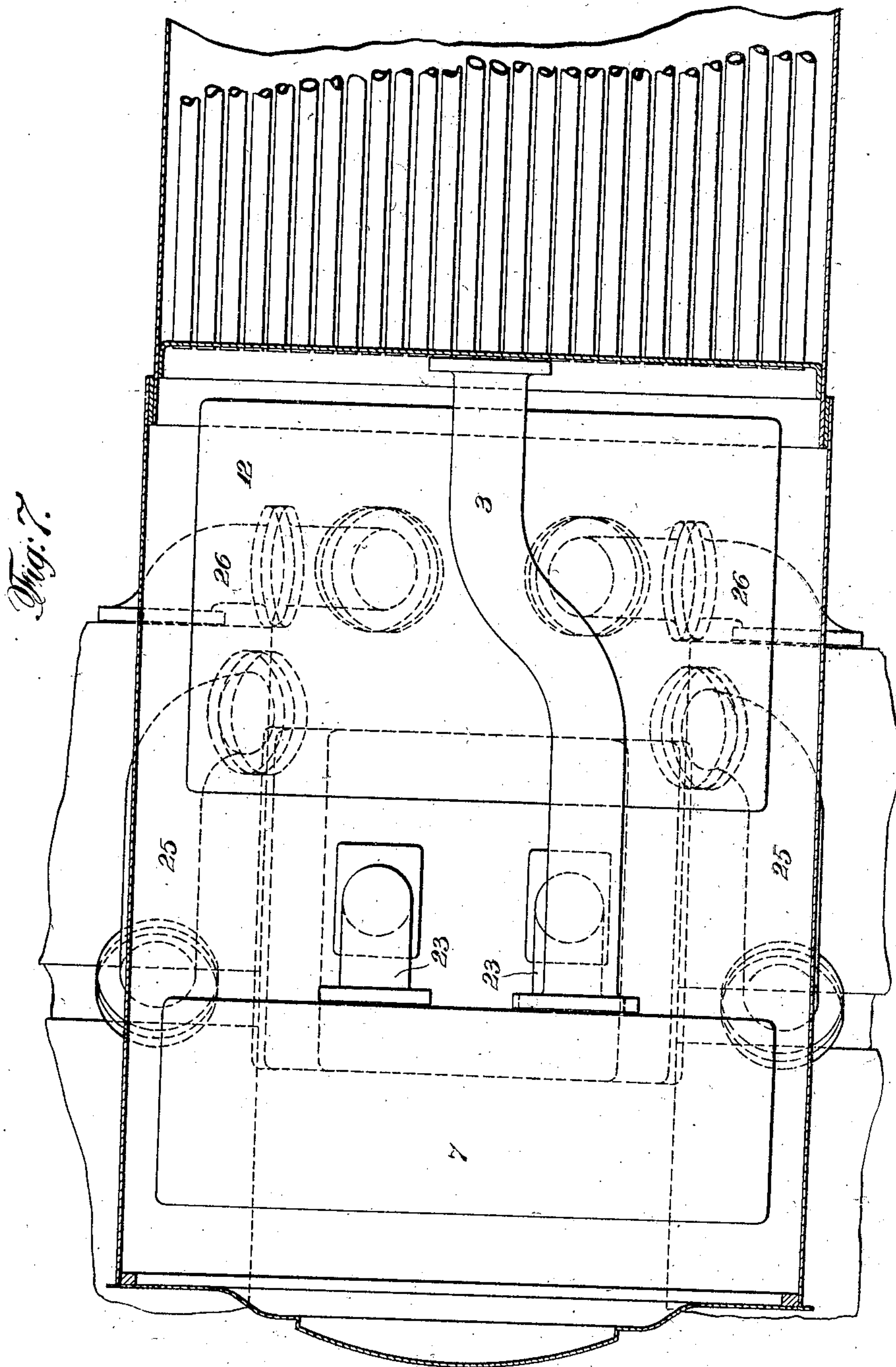
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Patented Feb. 9, 1909.  
7 SHEETS—SHEET 7.



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# UNITED STATES PATENT OFFICE.

HENRY W. JACOBS, OF TOPEKA, KANSAS.

## STEAM-SUPERHEATER.

No. 911,993.

Specification of Letters Patent.

Patented Feb. 9, 1909.

Application filed October 24, 1908. Serial No. 459,435.

*To all whom it may concern:*

Be it known that I, HENRY W. JACOBS, of Topeka, in the county of Shawnee, and in the State of Kansas, have invented a certain new and useful Improvement in Steam-Superheaters, and do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to steam superheaters and especially to superheaters that are used in railway locomotives.

My object is to provide a super-heater of the above character with as great a heating surface as possible for a given space, to so locate the parts that there shall be a very free circulation of flue gases through the super-heater, thereby rendering the heating of the surfaces of the super-heater more efficient and more rapid, to produce a more thorough and more rapid mixture of the steam being super-heated, to locate the parts in such a manner that they shall be thoroughly accessible so that they may be readily reached for the purpose of making repairs when necessary and also for the purpose of cleaning, and finally to locate the parts in such a manner that there will be a minimum of wear on the walls of the super-heater because of the contact therewith of the flue gases and cinders.

The details of my invention will be described hereinafter in connection with the accompanying drawings, in which—

Figure 1 is a fragmental side elevation of the front portion of a locomotive equipped with my super-heater; Fig. 2 is a longitudinal vertical section of the same; Fig. 3 is a plan view of the interior construction of the super-heater; Fig. 4 is a transverse vertical section taken on line 4—4 of Fig. 2; Fig. 5 is a similar section taken on line 5—5 of Fig. 2; Fig. 6 is an elevational view of another modification; and Fig. 7 is a plan view partly in section of the same.

In the drawings 1 is a cylindrical casing located at the front part of a locomotive and constituting the smoke arch of the same. The steam super-heater 2 which is located within this casing, is connected to the dry steam pipe 3; which conveys a supply of steam from the steam boiler 4 to the front section 5 of the super-heater. The front section 5 comprises an outer cylindrical casing 7 and an inner cylindrical casing 8. The cylindrical casing 8 provides a large transverse cylindrical opening which passes entirely through

the body of this section of the super-heater, the purpose of which will be hereinafter described. The body of this section of the super-heater 5, which lies between the two cylindrical casings 7 and 8, is composed of a plurality of longitudinal tubes 9 of small diameter, the ends of which are entirely open in the front and in the rear of this section of the super-heater, so as to provide for the free passage of the flue gases through the same. Steam is led into this section of the super-heater from the pipe 3, as already described, whence the steam is led around the various longitudinal tubes 9 therein. In order to cause an efficient circulation of the steam through this section of the super-heater, I provide it with a pair of spirally directed baffle plates 10, which extend from the top thereof, and one of which is situated within the other, as shown in Fig. 4. As an additional baffle plate, I locate a partition therein extending upwardly from the central cylindrical casing 8 to the outer casing 7. The pipe 11 is directed rearwardly from this section of the super-heater and is connected to the upper surface of the rear section of the super-heater 12. This is constructed with a plurality of longitudinal tubes 13, which are open both at the rear and the front of this section of the super-heater as in the front section 5 of the super-heater. A plurality of horizontally directed baffle plates 14 are located in this section of the super-heater. These extend alternately from opposite sides thereof, ending in proximity to the other sides of the super-heater. The steam is, therefore, compelled to pass backward and forward from one side of this section of the super-heater to the other around the baffle plates 14, until it finally reaches the outlet pipe 16 located at the bottom of the super-heater. After leaving this section of the super-heater, the outlet pipe 16 branches and is directed downwardly, as shown in Figs. 1 and 3, the branches being connected at their lower ends to the steam chests of the locomotive.

The exit of the steam through the pipes 22 into the steam chests may, if desired, be controlled by a throttle valve 17, having appropriate levers and connections for its operation. The exhaust steam, as is usual in locomotives, is permitted to escape into the stack; and to effect this, I provide the central cylindrical casing 8 of the front section of the super-heater 5 with a rearwardly directed



connection 18, which is connected with an upwardly directed pipe 19 leading to the stack of the locomotive, and with an exhaust nozzle or pipe 20, into which the exhaust steam is injected in an upward direction.

All of the seams in the two sections of the super-heater-including the fire tubes and the connections of the same, with the casings of the super-heater are welded together. The welding may be done autogenously, electrically or otherwise. Thus, with the exception of the steam connections the super-heaters are made of absolutely integral and solid constructions.

The complete operation of my super-heater is as follows:—Steam passes from the steam boiler into the dry steam pipe 3 and thence to the front section 5 of the steam super-heater. There the steam is brought into intimate contact with the outer surfaces of the longitudinal tubes 9, which are located in staggered relation to one another, so as to effectively mix the entire body of the steam. The baffle plates 10 then cause the steam to pass downwardly around the outer baffle plate to the bottom of this section of the super-heater, and thence downwardly from the other side of the super-heater around the outside of the inner baffle plate and then finally downwardly around the central cylindrical casing until the steam, after having traversed all portions of this section of the super-heater, is permitted to escape therefrom through the pipe 11. The pipe 11 leads the steam to the upper part of the rear section of the super-heater 12, where it passes back and forth from one side of the super-heater to the other around the transversely directed baffle plates 14. The steam finally passes from the super-heater through the pipe 16, controlled by the throttle valve 17, into the steam chests of the locomotive. The exhaust steam after leaving the cylinders of the locomotive escapes in an upward direction into the lower end of the exhaust nozzle 20. The steam exhaust passing up through this pipe carries with it the flue gases which are drawn in a rearward direction through the cylindrical casing 8 into the pipe 19 leading to the stack of the locomotive. The flue gases, pass from the fire-tubes 22 into the longitudinal tubes 13 of the rear section of the super-heater, though partly around the outside of the super-heater casing, then around the exhaust nozzle 20 and through the tubes 9 of the front section of the super-heater 5, though partly also around this section of the super-heater, and finally into the front end of the cylindrical casing 8. When it is desired to clean or repair the front section 5 of the super-heater, it is necessary merely to detach the removable front end of the locomotive casing, thus rendering the front section 5 of the super-

heater readily accessible. Should it be desired to clean or repair the rear section 12 of the super-heater, the same can be readily accomplished by removing the front section 5 of the super-heater and the exhaust nozzle 20. With these parts detached, it is also possible to clean the fire-tubes 22, inasmuch as the tubes 12 of the rear section of the super-heater are in alinement therewith. It will be seen that by this arrangement an extremely large heating surface is provided in the super-heater inasmuch as each of the sections of the super-heater is provided with innumerable longitudinal pipes located in staggered relation to one another, so that every portion of the body of steam being super-heated is compelled to come in contact continually with the heating surfaces, and for the further reason that the outer casings of the super-heater sections are also heated by contact with the flue gases. At the same time there is a very free circulation of the flue gases through the super-heater because of the location of all of the pipes in the same direction and in positions in which they constitute practically continuations of each other. Furthermore, in the case of the rear section of the super-heater the tubes thereof are located in direct alinement with the fire-tubes of the boiler. Again, all of the parts of the super-heater are very readily accessible and are also so located that they can be readily removed, if found desirable. Finally, the location of the various tubes through which the flue gases are caused to pass, makes it possible for the super-heater to wear for an unusually long period of time, inasmuch as the cinder sparks are not caused to be violently projected against any of the surfaces thereof.

Many changes might be made in the details of the construction and in the adaptation of my super-heater to any particular locomotive. The steam pipe connections are especially capable of many different arrangements to adapt my device to the needs of any particular locomotive or engine. Among other changes that might be made, are the connection of the rear section of the super-heater 12 with the steam chests of the low pressure cylinders and the connection of the front section thereof with the steam chests of the high pressure cylinders, it not being necessary to super-heat the steam to as high a temperature when used in low pressure cylinders as in the case where it is used in high pressure cylinders.

In Figs. 8 and 9 I have shown another modification of my invention in which the front and rear sections of the super-heaters are connected respectively to the high and low pressure cylinders of the locomotive, as above described. The modification shown in these figures differs from the modification of my invention already described, in that



the front section of the super-heater 7 is provided with a pair of downwardly directed outlet pipes 23 leading from the rear face thereof to the valve chambers of the high pressure cylinders 24, located on either side of the locomotive. The exhaust steam is led from these cylinders by means of a pair of pipes 25 to the rear section of the super-heater 12. Pipes 26 connected to this section of the super-heater lead the steam from the latter to the valve chambers of the low pressure steam cylinders 27, which are also located on either side of the locomotive. The steam is allowed to exhaust from these cylinders into the stack of the locomotive in the manner already described.

While I have described my invention above in detail, I wish it to be understood that I consider my invention to be a broad one and one capable of many changes and adaptations without departing from the spirit thereof.

I claim:

1. In a device of the character described, the combination, with a boiler having a smoke chamber and fire tubes opening thereinto, of steam superheating means comprising a plurality of separated sections provided with fire tubes in said chamber, the fire tubes of said sections being in alinement with each other and with the fire tubes of the boiler, and said chamber having an outlet leading from between said sections.

2. In a device of the character described, the combination with a boiler having a smoke chamber and fire tubes opening thereinto, of steam superheating means comprising a plurality of separated sections provided with staggered fire tubes in said chamber, the fire tubes of said sections being in alinement with each other and with the fire tubes of the boiler, and said chamber having an outlet leading from between said sections.

3. In a device of the character described, the combination of a series of superheater sections with which furnace gases come in contact successively, and means whereby one of said sections delivers steam to a cylinder of a compound engine and another section earlier in the series receives the exhaust therefrom and delivers it to another cylinder of said engine.

4. In a device of the character described the combination of a steam boiler, a stack, and fire tube steam superheating means comprising two separate hollow sections one in front of and one in the rear of the stack, all of the seams in the superheating means, with the exception of the steam connections being welded together, thus making each of the sections an integral structure.

5. In a steam engine the combination of a steam boiler and steam superheating means comprising front and rear sections each of said sections containing a plurality of fire

tubes, a front section being connected to the high pressure cylinders of a steam engine and a rear section being connected with the low pressure cylinders thereof.

6. In a device of the character described, the combination of a steam boiler, steam superheating means of the fire tube type comprising two separate sections one in front of the other, and a stack located between the sections, the steam exhaust passing up through the stack.

7. In a device of the character described, the combination of a steam boiler, steam superheating means of the fire tube type comprising two separate sections; a stack located between the sections, one of said sections being provided with a central opening, and means for causing the products of combustion to pass through said opening after having been led through the fire tubes of each section and finally into the stack.

8. In a device of the character described, the combination of a steam boiler, steam superheating means of the fire tube type comprising two separate sections, one of said sections being provided with a central opening, and a stack having an attached pipe connecting at its side with the central opening located between the sections, the steam exhaust passing up through the stack and drawing the flue gases through the central opening.

9. In a device of the character described, a stack, fire tube superheating means located partly in advance of the stack, and means for causing the flue gases to be led through and around the superheater to the front thereof and then to be returned to the stack.

10. In a device of the character described, a stack, fire tube superheating means in the front and rear thereof and a conduit directed horizontally and then upwardly intermediate the ends of the superheating means and connected to the stack.

11. In a device of the character described, a superheater comprising a substantially annular closed drum, a plurality of fire tubes passing through the interior of said drum, a partition in said drum extending from the wall of its central passage to its peripheral wall, a plurality of baffles in said drum, each abutting against its peripheral wall at one end adjacent said partition, extending around the central passage, and terminating adjacent the abutting end of the next one, and inlet and outlet connections for passing steam through the tortuous passage formed by said partition and baffles and the walls of said drum.

12. In a device of the character described, the combination with a boiler having a smoke chamber for receiving heated gases therefrom, of superheating means in said chamber comprising two separate fire tube sections with which the heated gases come in



contact successively, one of said sections having a passage therethrough, and means whereby the heated gases which have passed to the portion of said chamber remote from their point of entry are caused to pass back through said opening to an outlet in the wall of said chamber.

13. In a device of the character described, the combination with a boiler having a smoke chamber for receiving heated gases therefrom, of superheating means in said chamber comprising two separate fire tube sections with which the heated gases come in contact successively, one of said sections having a passage therethrough, and means whereby the heated gases which have passed to the portion of said chamber remote from their point of entry are caused to pass back through said opening to an outlet in the upper wall of said chamber.

14. In a device of the character described, the combination of a boiler having a smoke chamber for receiving heated gases therefrom, of superheating means in said chamber comprising two separate fire tube sections with which the heated gases come in contact successively, one of said sections having a passage therethrough, and means whereby the heated gases which have passed to the portion of said chamber remote from their point of entry are caused to pass back through said opening to an outlet in the wall of said chamber located between the two superheater sections.

15. In a device of the character described, the combination of a boiler having a smoke chamber for receiving heated gases there-

from, of superheating means in said chamber comprising two separate fire tube sections with which the heated gases come in contact successively, one of said sections having a passage therethrough, and means whereby the heated gases which have passed to the portion of said chamber remote from their point of entry are caused to pass back through said opening to an outlet in the wall of said chamber, said means comprising a pipe connecting at one point with said passage and at another point with the outlet in the wall of the chamber.

16. In a device of the character described, the combination of a boiler having a smoke chamber for receiving heated gases therefrom, of superheating means in said chamber comprising two separate fire tube sections with which the heated gases come in contact successively, one of said sections having a passage therethrough, and means whereby the heated gases which have passed to the portion of said chamber remote from their point of entry are caused to pass back through said opening to an outlet in the wall of said chamber, said means comprising a pipe located between the superheater sections connecting at one point with said passage and at another point with the outlet in the wall of the chamber.

In testimony that I claim the foregoing I have hereunto set my hand.

HENRY W. JACOBS.

Witnesses:

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